

**SOCIETY MEETING OF MARCH 23, 1994****HOT-HEADED DRAGONS: HEAD TEMPERATURE REGULATION OF DRAGONFLIES****Michael L. May**

Department of Entomology, Rutgers University-Cook College

Dragonflies are active predators on the wing and as such are exposed to a wide range of temperatures. Although the muscles which control their excellent flight abilities are adapted to operate at high temperatures, they still must be able to control their internal thoracic temperatures and indeed show a wide range of behavioral and physiological mechanisms to carry out this regulation. These mechanisms have been investigated over a number of years through the research of Dr. Mike May, Rutgers University, and his most recent results concerning dragonflies "hot heads" were explained and discussed.

Anyone can easily observe the behavioral regulation of temperature by dragonflies at any pond site when adults are present. Different behaviors are used to warm up or dissipate heat. For example, basking on a tree trunk in the sun takes advantage of a warm boundary layer of air and the adult warms up, while raising the body away from the surface, or changing the angle of the body to the sun can reduce unwanted heat. Some species even point the abdomen up and directly at the sun (termed "obelisk" position) to minimize exposure. Dr. May focused his research not on "baskers", however, but on *Anax junius* (Drury) a common pond species that remains almost continually active in flight and generates heat internally (endothermy). In early morning, the adult vibrates the wings with simultaneous contractions until the muscles, which are surrounded by heat-trapping air sacs in the thorax, reach flight temperature (about 35°C).

But what of the excess heat generated once the insect is in flight? Through the use of thermocouples in the thorax, abdomen and head, Dr. May noted that the three areas showed different trends in temperature increase in both lab and field studies: the thorax reached a maximum temperature at take-off regardless of outside temperature (indicating active regulation), the abdomen temperature increased only after take off and was related to outside temperature (indicating no regulation), and the head temperature showed fluctuations after maximum thorax temperature was reached and appeared somewhat independent of outside temperature (indicating some regulation mechanism). That some of this heat is dissipated from the thorax by the flow of haemolymph was clearly demonstrated by May when he clamped off the dorsal vessel flow to the abdomen and head, and noted that as thoracic temperature increased, head and abdominal temperature decreased. Yet the fluctuations of the head temperature, as opposed to the simple increase in abdominal temperature, indicate that the head is not simply a heat dump for the thorax as seen in the abdomen. Other reasons may influence why the head temperature is regulated, perhaps dealing with the dragonflies incredible visual acuity.

Also discussed was Dr. May's interest in the astonishing southward migrations (sometimes in the hundreds of thousands of individuals) of *Anax junius* observed in the fall. Also intriguing are the records of adults of this species in early spring in northern locales, apparently not due to local emergence, indicating a return of some adults from southern areas. Dr. May is interested in any early sightings of this species.

The meeting included a few notes of local entomological observations. Discussion initiated by Howard Boyd centered on the recent activity of insects stimulated by the last few days of over 20°C weather, including the first moths and paper wasps seen. About 25 members and their guests attended the meeting.

Jon K. Gelhaus  
Corresponding Secretary